Birmingham Bog outdoor laboratory:

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Birmingham Bog outdoor laboratory: potentials and possibilities for embedding field-based teaching within the undergraduate classroom

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Abstract

Providing cost-effective, hands-on field-based experiences to large cohorts of undergraduate students provides a core challenge for effective teaching and learning. This grand challenge is tackled through the construction of an exemplar outdoor learning environment within the Environmental Change Outdoor Laboratory (ECOLAB): Birmingham Bog (BB). Adjacent to the Geography building, the facility aims to produce a seamless, interconnected learning environment (in both space and time) that brings inaccessible fieldwork activities direct to the classroom at the time and frequency appropriate to the learning objectives. With the integration of this facility within a 3rd year undergraduate module, we explore through group interviews the ways in which BB adapted and influenced students' engagement with lecture material, and the extent to which the approach can complement or replace current field based teaching activities. The group interviews identified how BB was considered an example of 'effective learning' within the context of the wider degree

programme. However, if confirmed, the value placed on residential field courses cannot be met by such campus experiences. Despite this, BB represents an increasingly fertile space for deeper stimulation and innovative ways of learning; diversifying pedagogical techniques and enabling students to re-engage with lecture content.

Introduction

This paper assesses the potentials and possibilities of campus-based fieldwork to bridge the gap between lecture-based teaching and active learning, and the importance of student engagement with and feedback on new teaching practices. The case study of Birmingham Bog (BB) at the University of Birmingham considers the potential of innovative campus-based fieldwork techniques, and the involvement of student feedback on new techniques. BB forms part of the Environmental Change Outdoor Laboratory (ECOLAB) at the University of Birmingham. Situated adjacent to the School of Geography, Earth and Environmental Science, BB consists of a suite of peatland mesocosms (isolated, miniature peatland ecosystems) and associated hydrological instrumentation. These individual mesocosms are representative of northern peatland ecosystems that occupy large areas in Russia, Canada, the USA, Finland and Sweden. They are an important component of the global carbon cycle, containing at least one-third of the global soil carbon pool (Maltby & Proctor, 1996), and are often of high conservation value because of their unique vegetation and, to a lesser extent, faunal assemblages (Rydin & Jeglum, 2006).

Within geographical research, mesocosms are a widely utilized experimental approach that enable detailed examination of ecosystem function under controlled environmental conditions. Such mesocosm facilities also offer a representation of the field system that can be utilized within undergraduate teaching to provide visual and practical teaching that may be seamlessly integrated within a traditional lecture format. This study is based on group interviews with students who had used BB in lectures in the previous academic year. These were conducted to identify the ways in which BB adapted and influenced engagement with lecture material. BB was used by this study's participants in a final year undergraduate module, "Wetland Environments", which "… examines how wetland hydrology is characterized, investigating evapotranspiration, ground water and unsaturated moisture dynamics within these environments" (module handbook, University of Birmingham, School of GEES 2015/16).

The aim of this paper is to interrogate the role of field-based teaching in supporting undergraduate student learning on a case study programme, testing in particular the novel pedagogic approach of lecture-break visits to campus-based environmental mesocosms. This paper will consider how field-based learning has been conceptualized within the literature, before providing a brief overview of the pedagogical practice(s) used at BB and the methods involved in undertaking this case study. Narratives from student participants will consider the potential of campus-based fieldwork. The feedback on this module will be situated as an important factor in assessing and implementing new pedagogical techniques.

This paper concludes with the possibilities of campus-based fieldwork as an innovative learning opportunity to be incorporated into undergraduate teaching and learning. This is explored through four interconnected research questions:

(1) What is the role of field courses generally in supporting learning on the case study degree programme?

(2) How does the use of BB for field-based teaching on campus influence the way students learn and their engagement with lecture material?

(3) How has the use of BB impacted the students' experiential learning and their perceptions of teaching?

(4) What potential does this case study identify for campus-based fieldwork learning?'

Field-based learning

Field-based learning has been continually reported throughout the literature as an essential and central component in higher education (HE) Geography, Earth and Environmental Sciences (GEES) for more than half a century, and continues to be an integral aspect of college and university teaching to the present day (see Carlson, 2007; Fuller, 2012; Fuller, Edmondson, France, Higgitt, & Ratinen, 2006; Jarvis & Dickie, 2010; Lonergan & Andresen, 1988; Nairn, 2005; Scott, Fuller, & Gaskin, 2006; Wall & Speake, 2012). Field-based learning is profoundly popular with both students and teaching staff (Stainfield, Fisher, Ford, & Solem, 2000) and is described to be "successful in stimulating effective approaches to learning, regardless of age, gender or social background" (Boyle et al., 2007, p. 315), arguably representing "one

of the most effective and enjoyable forms of teaching and learning" (Kent, Gilbertson, & Hunt, 1997, p. 313).

It is widely recognized that learners "flourish" in active learning situations and learn best by doing (Higgitt, 1996), and such field experience is "vital for the development of students as qualified practitioners in all aspects of geography" (Hovorka & Wolf, 2009, p. 89). Wall and Speake (2012) state that the skills acquired in fieldwork are "unquantifiable", spanning subject-specific, transferable and social skills. Such skills are highly valued by employers, and considered essential for students to progress to become qualified geographers. However, the hidden agenda of fieldwork is at risk of being overlooked as HE institutions face a plethora of pressures such as increased student-staff ratios, higher costs and alternatives to traditional fieldwork being sought that are more time-efficient and cost effective, such as virtual fieldwork (Welsh, Mauchline, Park, Whalley, & France, 2013). These concerns and consequent alternatives are increasingly supported as the role of the field course is under scrutiny within the literature. "Effective learning cannot be expected just because we take students into the field" (Kent et al., 1997, p. 313) and Hope (2009) suggests that "geographers are wrong to privilege [fieldwork] over other modes of learning".

The effectiveness of the field course as a pedagogical tool and its role within HE Geography has actually been debated for longer than the most recent rash of accounts might suggest (Herrick, 2010). This can be attributed to a shift in the geography degree and related disciplines, ranging from changing objectives, new technologies and methodologies, to drastic changes in both content delivery and the higher abilities and expectations of students (France et al., 2015). With the enhanced capability to

introduce new technologies into field-based teaching and learning, there is the potential for technology-based pedagogies to become increasingly common, due to their connectivity and, "efficiency", and accessibility (Welsh et al., 2013). Erickson (2012, p. 9) states that this is a "wave of change that will indelibly alter the ways in which we engage our profession".

As a suitable platform for experimentation, HE practitioners have explored a variety of approaches to field studies, with the aim to integrate many theoretical and practical concepts taught within a geography degree. The field course has shifted in delivery from a passive and shallow-learning "look see"/"Cook's Tour" in the 1950–60s and progressed through a plethora of pedagogic styles with emphasis on deeper learning, through constructivist learning (Hovorka & Wolf, 2009); problem (Fletcher, France, Moore, & Robinson, 2007; McEwen, 1996; Scott et al., 2006) and enquiry based learning (Hill & Woodland, 2002; Jarvis & Dickie, 2010); student-centred learning (Marvell, 2008; Marvell, Simm, Schaaf, & Harper, 2013; Stainfield et al., 2000); community and social learning (Maskall & Stokes, 2008; Skop, 2009); and virtual learning (Carlson, 2007; Jarvis & Dickie, 2010; Maw, Mauchline, & Park, 2011; Peat & Taylor, 2012; Spicer & Stratford, 2001; Stainfield et al., 2000; Warburton & Higgitt, 1997).

It is increasingly essential that fieldwork delivery is effective and efficient, particularly due to the skills learnt and their relevance to future employment and their contribution to the student experience (Welsh et al., 2013), as well as being one of the largest items of recurrent expenditure within a geography department's non pay budget. Governing bodies responded to this in the late 1990's; the Teaching Quality

Assessment (TQA) of England, Scotland and Wales demanded universities critically examine their fieldwork programmes, and the government has continued to press universities in recent years to deliver an enhanced learning experience, and place students at the heart of the HE system (Mauchline, Peacock, & Park, 2013). These have been driving forces for change, leading to the production of "interesting and diverse fieldwork portfolios" with the aim of high student recruitment and retention (Mauchline et al., 2013).

Following such a shift in provisions and requirements in HE, it has never been more imperative to review the role of field-based learning within higher education: how it is adopted as a pedagogical practice; modified with enhanced technology (France et al., 2015) and adapted to the changing demands of both students and employers. As the student cohort becomes increasingly diverse, arising issues of the politics of the geography field course must be taken into consideration. "Markers of gender, age, socioeconomic status, race, language, sexuality and physical ability often delineate such field experiences" (Hovorka & Wolf, 2009, p. 90). The Special Educational Needs and Disability Act (SENDA, 2001), requires all compulsory classes to be fully inclusive (Maskall & Stokes, 2008, p. 6). However, traditional expeditionary-type and international field trips engender a multitude of inclusivity issues, including affordability, inaccessibility for disabled students; international destinations where gender inequality remains; language barriers, and culture shock (Stainfield et al., 2000). Disabled students often encounter attitudinal barriers to fieldwork inclusivity (of staff and other students) further to organizational barriers and physical barriers (Maskall & Stokes, 2008, p. 6). Similarly, a significant minority of students

experience anxiety caused by concerns over working outdoors all day and the physical challenge of fieldwork (Boyle et al., 2007).

Furthermore, the modern student is often faced with limited flexibility: the need for students to work while studying (Phillips, 2005); family commitments; or attendance may be restricted by ethical, ethnic or cultural considerations (Peat & Taylor, 2012). The emphasis on equality and diversity in HE means recognition of student exclusion is imperative. To overcome these barriers, many universities have reduced or removed fieldtrips from the curriculum, and instead utilized ICT, despite numerous claims that field course replacement with ICT is "unreflective replication of existing activities" (Phillips, 2005), in turn promoting student exclusion rather than diminishing it. The long-term future of geography fieldtrips is now threatened by a range of issues: student numbers and budget constraints (Hovorka & Wolf, 2009; Maw et al., 2011); management and timetabling difficulties; student flexibility (Phillips, 2005; Scott et al., 2006) and distance learning; and a number of political issues (Hovorka & Wolf, 2009) including disability (Stainfield et al., 2000), gender (Kent et al., 1997), race, (Hughes, 2016) and religion (Peat & Taylor, 2012); and increasing health and safety restraints (Herrick, 2010). Consequently, traditional fieldwork is reaching a point of unsustainable operation, demanding HE to enforce critical changes in fieldwork delivery (Herrick, 2010).

It is within this context of changing demands that pedagogical techniques are continuously monitored and adapted, particularly in the uncertain face of changing monitoring and evaluation of teaching, such as the UK's Teaching Excellence Framework (TEF). This will undoubtedly shape these techniques, practices, and

pressures on staff and students. These demands must be heeded in order to maintain student satisfaction, to ensure that students are prepared within their field; and are equipped with the ever-elusive "transferable skills" necessary to move beyond the degree on academic, professional and personal levels – all of which are increasingly critical to the ability of the university to continue to function.

The use of Birmingham Bog as field-based learning

ECOLAB is a research flexible mesocosm facility that was developed principally for research. Within this wider facility, BB has been constructed as a dedicated teaching environment. BB is a designated space that consists of 12 mesocosms. These are closed peatland systems that are representative of the ecosystem, but located externally from it. Ten mesocosms are circular (1.02 m diameter x 0.51 m deep) filled with Sphagnum peat, industrially extracted from an Irish peatland with a growing layer of Sphagnum moss. Two larger rectangular mesocosms, (2.5 × 0.5 m, 0.5 m deep) are also present, again filled with Sphagnum peat, one with and one without a growing moss surface. Geography and Environmental Science undergraduate students took the module "Wetland Environments" in the final year of their degree, and this was the first instance of BB being used in teaching (see Figure 1).

BB is used to supplement traditional lecture-style teaching and computer classes, as part of a varied and multiple bricolage of teaching styles in this module. Each of these serves a different purpose: lecture-style teaching provides a theoretical basis; the computer classes aid in numerical analysis and modelling of core system processes that provide the focus for the module assignments; and BB is a campus-based field

site. These three teaching techniques complement and reinforce one another (see, for example, Kasimov, Chalov, & Panin, 2013; Maude, 1991) to influence more holistic knowledges of wetland environments. Activities were undertaken at BB during each lecture, excluding those focussed on wildfire and peatland patterning due to health and safety constraints or timescale of processes being discussed.

The use of BB is structured and written into lectures. During a two hour lecture, a break is taken after one hour, where students and lecturer walk approximately five minutes to the site. Each activity within BB lasted for approximately 10–15 min. Activities undertaken at BB were generally demonstrations, followed by a closer look at the equipment used, before several questions were posed to the group, then returning to the second half of the lecture. In addition, where feasible, students undertook mini activities. For example, the installation of equipment and measurement of ecosystem properties, or small scale manipulations of the system to examine ecosystem processes.

The overarching goal of these periods within BB was to give students a rapid insight into the very different nature of this critical global ecosystem, and to be able to directly observe their form and function. This also allowed students to overcome perceived complexities of scientific instrumentation and to provide a wider sensory perspective on what it is to undertake field based research within these unfamiliar landscapes (Phillips, 2005). This represents far shorter periods of engagement in intensive fieldwork and thus the goal of the activities was not to replicate the immersive, socially engaging encounters that students would develop in traditional fieldwork teaching.

[Figure 1. BB; teaching facility housed within the Environmental Change Outdoor Laboratory (ECOLAB) at the University of Birmingham]

The proximity of BB to the lecture room is approximately five minutes walk away. It was anticipated that this break in the lecture would allow for reinvigorated concentration and engagement with the lecture material. Olmsted III (1999) claims these mid-lecture "breaks in the action" prevent declining attention and that such breaks should not be used for presentation of new material. Olmsted also suggests that such breaks should have three essential features: "change of pace, student involvement, and in-class assessment" (525). BB successfully serves these purposes, by removing students from the classroom, engaging them with the theories they are being taught in the lecture, and allowing them to assess their understanding through practical tasks. This is therefore not just a "break" from the lecture, but rather a teaching environment constructed specifically to invoke a sense of being at a field site (see Law, 2001). This sense of being in a fieldwork environment helps to construct BB as a learning space distinct from the classroom, thus offering time to explore the uses of different and embodied experiences of learning, in turn reinforcing lecture content. Thus, the structuring of BB into lectures allowed students to engage with equipment informally, whilst in the presence of a teacher, allowing the space to explore the uses of equipment and ask informed questions. BB is therefore part of a changing adaptation to the needs of students, whereby pedagogical research is actively integrated into innovative methods of teaching.

Assessing the effectiveness of BB in field-based learning

Group interviews were undertaken to question the effectiveness and potential uses of BB for final year undergraduate students, allowing participants to express a range of opinions, whilst also creating a space for debate (Winlow, Simm, Marvell, & Schaaf, 2013). The interviews used in this study followed a set of open-ended questions but were conducted in a semi-structured manner, to allow participants the opportunity to direct the group and shape the feedback given (Bennett, 2002). Similar to focus groups, group interviews "can be used to expose the differences, contradictions, unique experiences, views, perceptions and attitudes expressed by different group members" (Winlow et al., 2013, 2). This was perceived to be essential to understanding the interactions between group members, and for students to discuss and compare their experiences of the module (Worth, 2014). These were undertaken by independent researchers. This was in order to seek to redress power imbalances that may have stemmed from discussions taking place in front of those who were perceived to have control over, or authority over their degrees (Hopkins, 2007). The "unknown researcher" therefore reduced the likelihood of harm, and increased the potential for honest debate (Hopkins, 2007).

Two in-depth group interviews were undertaken with two and five students[1], comprising a representative sample (25%) of the class undertaking the "Wetlands Environment" module. These interviews took place after both teaching and examinations had finished, approximately 6 months after the conclusion of the module. The timing therefore lent itself to reflections on teaching and learning

[1] N=7

throughout the degree. Group interviews allowed for open-ended answers, as well as debate and deliberation, to provide richer opinion-based knowledges and discussion than is typical of singular interviews, which can be interpreted as interrogative (Valentine, 2005). Conducting interviews in a group also allowed experiential learning to be contrasted, reflecting individual differences and allowing students to compare their experiences. These interviews were then transcribed and coded prior to the analysis[2]. The themes for the results of this research were taken from this coding, using grounded theory (see Strauss & Corbin, 1994) to draw out and analyse the transcribed group interviews to build upon the key literatures in innovative pedagogical teaching in relation to campus-based field learning to guide coding. The range of questions reflects the overall aim of this case study, and sought to collect feedback on student experiences of learning after degree completion. The motivations behind such cycles of feedback, and the improvements that can be made on the basis of student feedback, are not only to ensure that the voices of students are heard, but also for critical insight into the teaching practices to be gained (Flodén, 2016; Hand & Rowe, 2010) (see Table 1).

TABLE 1: INTERVIEW SCHEDULE

What has been the most effective style of learning you have experienced through your degree programme?
Have field courses adequately supported your learning through the undergraduate degree?

[2] These group interviews were further supported by module feedback questionnaires given to the entire cohort of students over two consecutive years. While these are not included in the main discussion of this paper, they are referred to in the conclusion.

What are the primary benefits of field courses to you, and were these opportunities provided sufficiently through your degree?

Looking back on the Wetland Environments module, what is the primary memory of the module? What aspects of the module did you find the most enjoyable?

How did BB influence your learning in the Wetlands module?

How did the use of BB mesh with the lecture-based learning?

What improvements would you make to the use of BB within the Wetland Environments module?

Should BB be used more or less often, and/or differently, within the Wetland Environments module?

Could a similar approach be beneficial to other modules that you have undertaken?

Results and discussion

The results will be sectioned based on connected interview questions.

1) Background of pedagogical styles experienced in students' degree programmes

Although the questions were concerned largely with the effectiveness of on-campus fieldwork techniques at BB, there was also a desire to assess whether the use of field-based learning techniques within the usual lecture teaching was a memorable experience for the students. Students are more likely to recall and engage with experiences that "stand out" (Behr, 1988; Stewart, 1989). The purpose of this question was to probe whether the use of BB had increased student recall, by questioning the

most effective styles of learning throughout their degree. This allowed for a wider discussion of the myriad ways in which teaching is undertaken within this degree programme to understand what students considered "effective" teaching styles. Overwhelmingly, the most effective mode of teaching was perceived to be the practical and dialogic elements of the degree, where applications of lectures could be seen and experienced. There were no students who identified lecture-style or teacher-presentation as the most effective style, which speaks to one, or both, of two things: (i) that these "new" learning styles that engage technologically or practically with students "stood out", or (ii) that they enabled learning and recall more effectively.

B1[3] : Probably like the practical stuff, like computer practicals and stuff like that because you can actually put it into practice what you have been taught

B2: … seeing the more applied element of it, like the stuff with the BB

Seminars, computer classes, and BB were identified as the most effective ways of learning. Students' recollection and identification of these contributes to further understandings of the changing desires for more engaged and proximally "close" ways of teaching that not only deal with abstract knowledge, but focus on the real and demonstrable uses of knowledge. It was particularly interesting that although this question was asked in relation to the whole degree course, BB was pinpointed as a named example of "effective learning".

[3] To anonymize participants, a letter (A or B) is a group interview identifier, and the numerical value identifies the student participant.

2) The use and implementation of field courses

Within this degree, there are two field courses in which students undertake independent research on residential courses. Through the group interviews, student participants were asked about their wider field-work experiences, in order to situate BB as a campus based field site within the wider fieldwork learning context. Residential field courses take place in the first and second years, with the former being UK-based and jointly working with human geographers, and the second generally being an overseas, solely physical geography or environmental science course. The final year of this degree has not previously been considered to have the scope to run a residential field course, due to other commitments, namely the dissertation. BB seeks to address this lack of field-course, to provide a space for field-based learning without going to "the field" (Hovorka & Wolf, 2009; Katz, 1994). This can also aid in students' reconceptualization of what and where the field is. The responses to this question suggested that BB was not seen as a fieldwork site, but has the potential to be used in this way. Overwhelmingly, students identified that field courses were useful, interesting and effective in applying the abstractions of lectures to the field. This practical application of knowledge is particularly valued, but not necessarily perceived as being done in the most effective way:

> B4: I don't know if support is the right word, because I don't think they go hand in hand with the rest of our module choices because they are in their own right a standalone module and we gain the necessary skills and confidence through them because we are often made to give presentations and stuff.

B5: I think they add to the degree and we shouldn't not have it because I think it is one of the best ways of learning but I don't think it goes hand in hand with all of the modules, which at the same time, it shouldn't.

B4: We had to do human stuff for half of our fieldwork in first year and half physical, which helps because you get that broad scope, but if you already know what you wanna go into, you feel like you are having to do something …

The overall responses towards field courses were positive; that "going to the field" enhanced both learning, and the degree experience. Nevertheless, there were still issues raised, broadly falling into two concerns: (i) the disjuncture with other modules; and (ii) the undertaking of non-relevant fieldwork. These concerns were, without exception, compounded within positive feedback about the necessity of field courses. This suggests that although field courses are examined as a standalone practice of independent fieldwork, there is a perceived disconnect from the rest of the degree for students, which needs to be addressed in teaching. Residential field courses, rather than being supplementary, can be repositioned as critical to developing the practical and technical skills necessary to complete the degree (see also Fuller, Rawlinson, & Bevan, 2000; Glass, 2015). Students also recognized the wider settings of field courses, illustrating their knowledge of the practical applications not only of their work, but also of the way they enact learning:

B4: I feel like presenting an alternate work environment can stimulate the brain in ways that you didn't think were possible prior, so taking people out of

a classroom, putting them in a new environment, making them talk to people they never have before on the course, can stimulate that deeper learning so I think it is really important, I feel like we were a bit of a loss because we didn't get much fieldwork opportunities at third year

B1: Some of my modules could have had like just like odd trips and stuff, like I know for one of them, biodiversity and conservation, we had one lecture where we went down to Edgbaston pool and did a practical session there and I feel like more of the modules could have that

B2: just like one day, where its like lets go out and look at this because its like this is the, we did river restoration and that's literally one day, you go to some rivers'

This discussion point most notably highlighted that there was a strong desire for fieldcourses, both prior to enrolling as a "pull" to certain universities, and during the course for both social and academic reasons. It would be a mistake to ignore the non-academic desires of students in the scope of the university, and the focus on interactive learning and teaching in practical exercises as a place to talk to their colleagues can be valued in such spaces as an to developing the skills to work in new places with different people, both peers and lecturers (see Hart, Stafford, & Goodenough, 2011; Orion & Hofstein, 1991; Borzack, 1981; see also Dunphy & Spellman, 2009; Fuller, Gaskin, & Scott, 2003; and Cotton, Stokes, & Cotton, 2010 on the wider issues of skills developed by fieldwork). The value placed on these residential field courses thereby suggests that measures should be taken to address

concerns that campus-based, or one day field trips, will replace residential courses. These insights allow for an understanding of the ways in which students value fieldwork which is essential to considering BB and future uses campus-based field sites. These critiques position BB as an increasingly fertile field site space for deeper stimulation and innovative learning, to build upon and enhance the skills practiced in residential field-courses.

3) The Wetlands environments module: reflections

In this section, we move to consider the discussions directly relating to the Wetlands Environment module, both negative and positive teaching/learning experiences. It was largely agreed that the "primary memory" of the module was the difficulty of computer classes, particularly in modelling and "getting to grips with" (A1) software. Despite this not being regarded as the most "enjoyable" part of the course, it was widely agreed that it was the most effective teaching in aiding formal assessment. The responses suggested a strong desire for learning to have an immediately evident applicability and purpose, and an increasing sense of urgency, moving from discussing the fun and social aspects of field courses, to an increased importance assigned to assessment and practicality. This was very clear in the changed focus of their discussions when the topic changed from first or second year work, such as field courses, to their final year modules. This suggests changing priorities for undergraduate students progressing through their degrees, beginning to focus on their steps beyond the undergraduate university. This is not an unexpected finding, but nonetheless reinforces that students' input into module design and new pedagogical techniques should be further considered in HE.

4) Birmingham Bog: practice and usage

It was clear that BB engaged students, in physical and intellectual ways. For example, several students talked about how the break in a two-hour lecture, which is usually filled with conversations or eating and drinking, was used far more effectively by walking to and undertaking practical exercises. There was recognition here of the physical and mental effects of the lecture break (Olmsted III, 1999; Young, Robinson, & Alberts, 2009) almost unanimously, mentioning that the use of BB engaged with "different ways of learning", as well as reinvigorating students from lecture-style learning. It was this act of leaving the classroom to "see" those abstract theories, that students believed allowed them to re-engage with the content of the lecture: to "wake up" (A2) their brains, and extend their ability to focus and participate actively in learning. This situates BB as having a distinct affective capacity in relation to its use as an innovative teaching environment. This understanding of the physical and psychological benefits of BB as a pedagogical tool were confirmed in these discussions of activities at BB:

> B3: I'm quite a kinaesthetic learner, so it worked definitely to see when you are talking about this theory and you're talking about how you are going to measure this and something, it definitely helped to sort of see it being done and I mean usually participate in it as well

> B2: I think it invited more questions and a conversation about what he was actually doing and how you actually do it, which possibly wouldn't have been asked if we'd have just learnt it in the classroom

> A2: Yeah, it wasn't used every lecture it was only used when applicable, which adds to the whole fact that it kept our brains engaged for that little bit longer

> A4: Definitely enhanced [the lectures], because like you said, like you, like this is what you need to know, and this is how it's done … so yeah you kind of see it being done in action as well

These responses indicate that critical dialogue was enhanced at BB, allowing for students to "see" what they had learnt, which invited further questioning and discussion of how these practices would be used "in the field". The students identified the ways in which they learn differently from one another, and considered how best they believe they learn. This process of learning in action has therefore had an influence on those undertaking the module, to learn how they learn. However, this cannot necessarily be assumed a result of BB. It may also be influenced through students' reflexivity on their own learning within and as a result of the interactions in the group interview context (see Wibeck, Dahlgren, & Öberg, 2007) This "learning in action" connects with recent work focusing on the affective nature of fieldwork. The embodied experience of engaging with the taught material supports this affective capacity of the bog as a teaching and learning environment. This places the use of BB as distinctly different to, and also more than, just a break from the lecture (Glass, 2015). The BB environment enhanced the lectures, connecting the abstract ideas into a practical understanding through the demonstrations in this space. Therefore, the purpose and intent of the walk to, and activities at, BB, shape this space as one of "fieldwork", distinguishing it significantly from just a 10 min walk. It was clear that

students found BB to be a useful enhancement space within lectures, but it was important to also assess the potentials of BB as a standalone learning and fieldwork site, which will be considered in the final section of the discussion. Students raised several critiques of BB, and the way it was used, signposting the way towards its potential future uses. At the conclusion of the first year of BB being used in lectures, these group interviews allowed an evaluation of student engagement, and to understand their vision for integrated on-campus fieldwork into teaching.

5) BB: the future

The BB learning space has been emphasized as valuable in diversifying pedagogical techniques, allowing diverse engagements, and for a longer period of time by the student participants. This section will present some critiques of BB, but also the ways in which students envisioned BB could be used differently within this module, and more widely across their degree, before offering reflections more widely on campus-based fieldwork. This section will present findings divided into three sub-sections: (i) positive learning experiences at BB; (ii) potential of more interactive and practical exercises; and (iii) opportunities for earlier engagement with BB.

a) The positives of BB

Overwhelmingly, students presented a largely positive opinion of BB, picking up specific learning "styles" that it benefitted, as suggested by student participant B3 in the previous section, and reflecting on the improved discussion, which was directly linked to being at, and engaging with, BB: B4: I think the bog itself is a really good

resource and I think it is really nice to see it integrated into learning over time … so then when you discuss the principles later on you can be like, remember when we did this Resonating with other studies (e.g. Higgitt, 1996; Hovorka & Wolf, 2009) on the way students learn through different techniques, students identified that lectures cannot facilitate practical and embodied knowledges. It is the visualization and practice of these techniques which enhanced their ability to question and understand, further supporting the construction of BB as having an affective capacity as an innovative learning space to engage with lecture material.

b) The practical potential of BB

Despite the overall positive assessment of BB, students easily identified the need for the space to be used in more interactive ways, similar to other studies, such as Day (2012), who suggests "deeper learning is facilitated when fieldwork engages students. Learning is reinforced through social interactions" (p. 316). They identified the creative potential of BB in innovative pedagogy (see Boyle et al., 2007), recognizing that this has not yet been achieved:

> A1: … it would be nice to do something more practical at the Bog, because we just sort of stood there and listened to them explain the Bog, but it would nice to have actually, I don't know, do some measurements there so we could … because you showed us how we would measure things, but if we had actually done it, it would have been more effective in helping us learn, because that is only audio learning whereas if we did practical it would be more … other types of learning

B2: I feel like it can be used more than it has been so there were those people in class that did stand at the back and didn't contribute so I feel like maybe even as part of the formative assessment if we had the opportunity to collect our own data using some of the instruments, some basic principles, some, just to begin with to get involved with because I remember walking out there and being like, oh my god what is all this, so to be able to interact with it rather than just watch [the lecturer] and then volunteer yourself, because there are so many like, there is so much that you can do out there

B3:… if we had collected more simple data for ourselves … it might have been easier to write up. Because we were just given a data-set and not really told much about it and I think you get quite bogged down trying to understand what it actually means and what it is about and you don't actually think about the way that you are writing it up

The students here identified the potential for an even more (inter)active learning experience at the BB, identifying it as an invaluable but under-used resource. While they were aware that there was the possibility to approach lecturers to use the space, there was a preference that the time spent here should not only be within structured lectures, but as a campus-based field site for independent research. Whilst students envisage more hands on activities as important to maximize the benefits of BB, this requires either an increase in contact time or a substantial reduction in the wider activities covered within the more formal components of the module. Whilst an increased contact time requires additional resources, this increase will be limited due

to the student-focussed nature of such actives. With the added perceived benefits by students of increased understanding and engagement, such developments are considered strongly worthwhile. The capability to effectively integrate lecture and field based activities provides a core challenge to the effective application of this pedagogic approach. We hope that the development of such teaching and research facilities will consider the added benefits of their development in close proximity to teaching facilities. The proximity to such learning facilities can also be considered a priority in room selection during university level timetabling. Placement of such facilities greater than 10 min from lecture facilities would lead to a clear disconnect between the formal teaching and field based activities and, due to time constraints, would likely prevent the direct incorporation of such activities within the formal lecture setting.

c) Earlier engagement with BB

Students were not only engaged with how BB could be practically used differently, but with how BB could have proven effective elsewhere in their learning throughout the degree. The students identified here that not all students are necessarily invested in additional resources, but that having such a resource as BB was of value:

> B1: I think adding onto the first year … but it will also help in subsequent years because I think when you start second year and you have to think about a dissertation, you have to formulate a project, completely by yourself and having a bit more of a background from first year in just collecting data would help

B4: Obviously you have got logistical difficulties because you have got what, 300, 400 students? But yeah it might have been something that would have been helpful

B3: yeah I think if, from first year if you know it is a resource and you know that we have it, and I suppose if any of us messaged [lecturer] and just said oh can we go and check out the Bog for a bit for a project, that wouldn't be a problem –

B4: even like, and I don't know whether he does do it now because obviously a long time ago, before it was even constructed I guess, but even if he just said at the end of a lecture, if you want to know about these, we have the BB I can show you, you know? Or you can have a look?

The assessment of BB as a pedagogical tool was as an innovative way for students to engage with practical exercises and exploration of equipment, as well as a proximally "closer" way of learning. This was counterbalanced by the perception that the use of BB as a resource was "not quite there yet". It is evident that students see potentials for BB as a learning site, more widely than just to their own studies, and have raised several valid points for how we can integrate into our teaching new pedagogical methods. This has confirmed that student feedback is vitally important to a university that is engaged with the communicated needs of its students in developing innovative pedagogical techniques (Winlow et al., 2013; Worth, 2014).

The possibilities of BB, and evaluating the potentials of campus-based fieldwork

The case of BB has made it clear that there is a need to continually evaluate student feedback to understand and meet their needs and desires. By including and ensuring that there are multiple ways for students to engage with lectures, there is expanding potential to satisfy the changing learning needs and embrace new techniques, as well as facilitate discussion and include students in the future of the university, outside of the National Student's Survey, allowing more detailed feedback on specific areas of their course. With increasing numbers of both physical and technological learning environments being developed, (Fletcher et al., 2007; Jarvis & Dickie, 2010; Peat & Taylor, 2012; Spicer & Stratford, 2001), there is a unique opportunity to diversify teaching and learning environments, one that values student participation in creating effective spaces.

With specific reference to the BB, the innovative ways in which such an environment can be used can be explored more deeply and widely through this feedback, in order to open BB out to be used in more interactive ways than has been done thus far. In its current form, the facility targets a comparatively small student group within a third year module. This analysis demonstrates the clear potential for this facility to expand in how it is applied within undergraduate teaching, both in terms of the formal and informal way that students engage with the facility. The examination of peatland ecosystems has been targeted at students' understanding of wetland hydrological processes. This represents just one component of the geography of these complex and globally important ecosystems. Peatland function transcends the traditional

components of a physical geography degree programme, offering the potential to integrate the facility within the teaching of hydrology, ecology, biogeochemistry, geomorphology and paleo ecology to name a few. The facility can thus become a test bed for hands on field-based approaches embedded within current undergraduate modules. Further, ECOLAB represents flexible facilities with the opportunity to construct mesocosms to represent a range of different processes and/or global ecosystems (see Figure 2).

The design should not be limited to wetland systems, but should only be limited by the imagination of the module lead, from mesocosms exploring river ecological processes with recirculating streams (Ledger et al., 2013) to restoration processes and biodiversity within grassland communities (Fry et al., 2017). Whilst there are benefits of the current approach, it is clear that in order to maximize the impact of the facility, students must be engaged throughout the course of their degree programmes and this engagement must increase the practical interaction with the mesocosms. Individually, there are restrictions with both of these student needs; including large student numbers within 1st year modules, and the increased time necessary for students to engage effectively with the facility.

However, BB offers the opportunity to embed independent student led teaching more widely within the scope of the undergraduate degree, introducing field based physical geography measurement methods throughout students' degrees. Further, the desire of some students to engage with BB outside of the formal components of the undergraduate teaching offers the potential for individual students and/ or associated student societies to engage more widely with the facility, and potentially for BB to be

developed as a facility "owned" and managed by students to foster much-needed students engagement and development of wider key transferable skills.

Figure 2. Suggestions for using mesocosms beyond wetlands in teaching.

Conclusions

The desire of students to engage more deeply in the practical element of BB was further elaborated in subsequent questionnaires. These were undertaken from this cohort, and the following cohort of students, where they were asked to evaluate the ways in which they had learned most effectively. Responses to this further situate BB as a highly effective way of learning embedded in lectures. Unlike the group interviews, these questionnaires were given as a wider feedback opportunity of their degree, yet around 50% of the students pinpointed BB as the "most effective way of learning". Some responses from these questionnaires included: "Birmingham Bog [best helped learning] to be able to see systems in real life to consolidate learning" (2017A); "more Birmingham Bog trips would have helped learn more effectively" (2017B). "Using the Birmingham Bog was great in aiding learning" (2017C); "The style of lecturing: not always in a classroom, going out to ecolabs" (2016A); "the explanations in the Ecolab were very useful, practicals were enjoyable and challenging" (2016B); "the variance in lecture format" (2016C); "the use of different methods, e.g. Ecolab best helped learning" (2-16D). The direct comments on BB therefore demonstrate that BB has not been seen as simply a novelty, but rather a valuable, memorable, and effective inclusion in the teaching techniques of this module.

Where typically “feedback forms” are the evaluative tool on which universities rely, this case study took the form of group interviews, which allowed for deeper explanation and engagement with assessing the module. While this would not be feasible for each and every module a student undertakes, it is perhaps important when innovative techniques are being integrated for the first time. This allows for the identification of any issues, and tailoring of the use of these spaces to be implemented at an early stage.

In line with the overall aim, it has revealed the need to engage students in the teaching and learning process. BB has the potential to continue to be a site for these debates, and a practice of the ways in which undergraduate students can become increasingly involved in the planning and structuring of their own education. This research has revealed not only the ways in which field-based learning can be used, but also how this can be integrated with student’s desires for their degree and time. Their feedback has revealed the differential ways in which they see the module and the use of campus fieldwork, as opposed to the more idealistic way that innovative pedagogical techniques can be perceived from a lecturer perspective. Such insights allow us to improve and adapt our pedagogical techniques to fit with these desires.

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Figure 1: BB; teaching facility housed within the Environmental Change Outdoor Laboratory (ECOLAB) at the University of Birmingham

Suggestions for using mesocosms beyond wetlands in teaching

Mesocosms have wide and varied applications across the breadth of geographical disciplines and ecosystem types. Biosphere 2, dubbed the "world's largest test tube" by Allen, Nelson and Alling (2003) exemplifies this, representing rainforest, desert, savannah, fresh-water and salt-water marsh and coral reef oceanic systems. It recreates the flows, processes and balances that occur on Earth on much smaller scales for these grand ecosystems. Therefore, the accelerated cycles within these experimental mesocosms can be observed on shorter time scales, enabling much faster learning and greater understanding of these systems. These invaluable advantages for scientific research could also be applied to teaching in higher education. Stewart et al., (2013) provide an extensive review of the use of mesocosm experiments to research ecological climate change; here we present just a few examples of mesocosm use that could be adapted for on-campus field learning.

System Type	Experiment (environmental change)	Metrics	Author
Marine ecosystems	pCO2 enrichment of mesocosms filled with local seawater	biogeochemistry, plankton physiology and population dynamics, and community structure (over 19 days)	Engel et al., 2005
Freshwater lentic ecosystems	temperature increases and variation in lentic system mesocosms	the interactive effects of nutrient enrichment and predation pressure with	Feuchtmayr et al., 2010

		warming	
Freshwater lotic ecosystems	mimicking low flows associated with drought using flumes	food web connectance species turnover, food-chain length, species richness	Ledger et al., 2013a, b
Terrestrial ecosystems	the effects of temperature increases and CO2 levels on belowground microbial processes	soil microbiota responses to: CO2, temperature, substrate availability, water, and community succession	Tscherko et al., 2001

Figure 2: suggestions of other types of mesocosms in teaching